

## SOIL SCIENCE

## Microbiological Changes in Freshly Moistened Soil

It is well known that when a dried soil is moistened there is a burst of respiratory activity. Drying, in some way, renders a part of the soil organic matter soluble and it has been considered that the decomposition of this fraction by micro-organisms partly accounts for the high respiration-rates recorded. The composition of this soluble material has not been fully determined, but it has been shown to contain appreciable amounts of several amino-acids<sup>1</sup>. In these circumstances the development of a specialized zymogenous population might be expected. Indirect evidence for the existence of such a population has been provided by Chase and Gray<sup>2</sup>. They made a detailed analysis of the respiration of freshly moistened soils and concluded that their results could be best interpreted by assuming that two major microbial populations were involved, namely, one with a low rate of metabolism—the autochthonous population—and the other with a very high rate—the zymogenous population.

Observations made recently on the behaviour of the bacteria in an East African soil (Kikuyu red loam) provides direct evidence for this interpretation. Soil which had been dried was re-moistened to field capacity and maintained at 25° C. Rate of carbon dioxide production and bacterial numbers were recorded at 3-hourly intervals for a period of 36 hr. Carbon dioxide was determined in the macro-respirometer devised by Birch and Friend<sup>3</sup> and bacterial numbers by direct cell counting<sup>4</sup>. Note was taken of the morphology of all cells scored and it was found that the two main cell types (cocci and rods) showed marked differences in their distribution over the 36-hr. period. From Fig. 1 it can be seen that a comparatively small increase in coccoid forms occurred early, their numbers then remaining at a fairly steady value. Rods, on the other hand, showed no increase until after 12 hr., when their numbers increased rapidly to a maximum at 24 hr.

It will be recalled that Winogradsky<sup>5</sup> considered the autochthonous flora of the soil to be composed almost exclusively of cocci and very short rods, whereas the zymogenous flora comprised spore-

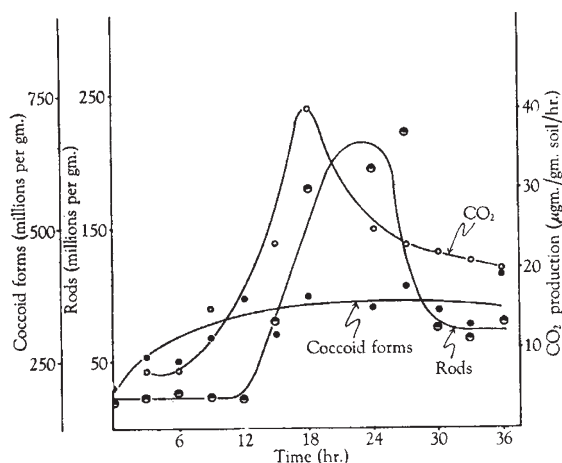


Fig. 1. Carbon dioxide production (○) and development of bacterial populations in moistened soil. ●, Coccoid forms; ○, rods

formers and long rods. The present results can be interpreted as showing that the rods constitute the zymogenous part of the population and, in fact, are responsible for the greater part of the flush of carbon dioxide. Although numerically they do not at any time constitute more than 50 per cent of the total population, their size in comparison with the cocci is such that they must, during their brief period of growth, constitute the greater part of the active cellular material in the soil. Moreover, it is well established that maximum physiological activity occurs during the lag and early log phase in the growth of a bacterial culture and it is clear that in the present instance maximum carbon dioxide production coincides with this part of the growth curve of rods rather than with the point of maximum number.

This work, which is being continued and will be reported more fully elsewhere, was undertaken when one of us (E. G.) was in receipt of a travelling grant from the Colonial Office.

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<sup>1</sup> Stevenson, I. L., *Plant and Soil*, **8**, 170 (1956).

<sup>2</sup> Chase, F. E., and Gray, P. H. H., *Canad. J. Microbiol.*, **3**, 335 (1957).

<sup>3</sup> Birch, H. F., and Friend, M. T., *Nature*, **178**, 500 (1956).

<sup>4</sup> Jones, P. C. O., and Mollison, J. E., *J. Gen. Microbiol.*, **2**, 54 (1948).

<sup>5</sup> Winogradsky, S., *C.R. Acad. Sci., Paris*, **178**, 1236 (1924).

## MISCELLANY

## Letter from Erasmus Darwin to Jonas Dryander

THE following extract from a letter of Erasmus Darwin to Jonas Dryander seems worth noting. The letter is in a small collection in the Department of Botany, British Museum (Natural History) labelled "Dryander Correspondence".

"Derby, May 21—87

... I must now beg another favor of you, which is to give your suffrage to my Son, Dr. Robt. W. Darwin, whom I wish to be a member of the Royal Society, which might add new spirit to his industry in philosophical pursuits; & should be much obliged to you to present my best compl. to Dr. Blagden, when you see him, & ask for my Son the same favor from him. Mr. Ch. Greville has spoken to Sr. Joseph Banks in his favor, whom I should otherwise have troubled with a letter on this account. Doctor Robt. Darwin is settled in Shrewsbury, where he meets with very great encouragement, having been concern'd for near fifty patients in the first six months; & I dare say will make a very useful member of the Society."

Robert Darwin "began to practise before he was twenty-one years old" (Charles Darwin, *The Autobiography*).

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